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REMARKS

Claims 1-13 are pending in the application. In the Office Action made final at hand, Claims 1-12 are rejected, and Claim 13 is withdrawn from consideration.

With regard to the objection of Claim 9 as being a substantial duplicate of Claim 4, both Claims 4 and 9 have been canceled.

Claims 1-12 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Stevens. In addition, Claims 1-12 are rejected under Section 103(a) as being unpatentable over Stevens in view of Shinmoto. Furthermore, Claims 1-12 are rejected under Section 103(a) as being unpatentable over Stevens in view of Grosset. Finally, Claims 1-12 are rejected under Section 103(a) as being unpatentable over Stevens, Shinmoto and Grosset. In response to the Section 103(a) rejections, the Applicants respectfully submit that Claims 1, 2, 6-8, 11 and 12, as amended, are not obvious in view of Stevens, Shinmoto and Grosset. Reconsideration is respectfully submitted.

Claim 1, as amended, recites an extrusion die including an inner die portion having a male form. The male form has a male complex shape with peaks and a valley. An outer die portion has a female form. The female form has a female complex shape with peaks and a valley which corresponds to the male complex shape of the male form. The female complex shape surrounds and is separated from the male complex shape by a gap. Flowable material is capable of being extruded through the gap between the male and female complex shapes to form a hollow profile. An adjustment mechanism includes an outer member surrounding the outer die portion. At least eight adjustment screws are threaded through the outer member and engage a flange extending from the outer die portion at equidistant angular locations and configured to provide controlled incremental linear and rotational adjustment of the female complex shape relative to the male complex shape for adjusting the gap and for adjusting the position and orientation of the corresponding peaks and valleys of the male and female complex shapes relative to each other. The outer member has an annular shoulder with an opening through which the outer die portion passes. The annular shoulder captures the flange extending from the outer die portion and extends into a groove adjacent to the flange. The annular shoulder and groove are configured to allow movement of the outer die portion relative to the outer member.

Claim 1 has been amended to recite "at least eight adjustment screws threaded through the outer member and engaging a flange extending from the outer die portion," and "the outer member having an annular shoulder with an opening through which the outer die portion passes, the annular shoulder capturing the flange extending from the outer die portion and extending into a groove adjacent to the flange, the annular shoulder and groove being configured to allow movement of the outer die portion relative to the outer member." Claim 8 has been amended in a similar manner. Support for these amendments is found at least in FIG. 1, as well as on page 4, lines 19-27 of the Specification as originally filed. No new matter is introduced.

In one illustrative embodiment of the present invention (FIGs. 1-5), the male 16a and female 22a forms of the inner 16 and outer 22 die portions both have multiple peaks and valleys or indented portions, for example, valleys at locations 25 and peaks at locations 27. Such forms are complex and in the prior art have been difficult to adjust. However, the gap 24 between the male form 16a and the female form 22a can be easily adjusted by the claimed adjustment mechanism so that a profile can be extruded through the gap 24 with the desired wall thickness characteristics.

The adjustment mechanism can have eight adjustment screws 20 extending through an outer member or retaining ring 18, which are configured to provide controlled incremental linear and rotational adjustment of the female complex shape relative to the male complex shape. In some embodiments, more than eight adjustment screws can be employed.

The adjustment screws can engage a flange 28 extending from the outer die portion 22. The outer die portion 22 can be secured to the spider pipe 12 by capturing the flange 28 with an annular shoulder 30a of the retaining ring 18. The outer die portion 22 can extend through opening 19 of the retaining ring 18 and annular shoulder 30a. The annular shoulder 30a can extend into a groove in the outer die portion 22 that is adjacent to the flange 28, with the annular shoulder 30a and groove being configured to allow movement of the outer die portion 22 relative to the retaining ring 18 and adjustment of the outer die portion 22. This configuration can provide an extrusion die with an adjustment mechanism and outer die portion that are simple and compact with a minimal number of parts, for adjusting dies with complex shapes, thereby allowing for easy operation and maintenance. This design can allow adjustment of the outer die portion during operation which typically was not possible in the prior art, and can provide a more tortuous path for preventing entry of contaminants.

By making controlled incremental linear and rotational adjustments with the claimed adjustment mechanism, the position and orientation of the female complex shape can be adjusted relative to the male complex shape with precision so that the proper gap on all sides of the male complex shape can be made. In addition, corresponding curves of the peaks and valleys of the male and female complex shapes can be properly positioned and oriented relative to each other and symmetrically on both sides of the axis of symmetry. Prior systems have not been able to adequately adjust such multiple peaks and valleys, or during operation, as possible in the claimed invention.

In contrast, Stevens discloses a simple extrusion die having a triangular inner male portion with only peaks (FIG. 7), a triangular outer female portion with only valleys, and a gap formed therebetween. Four centering screws 20 in opposed pairs (FIGs. 2 and 9) can adjust the outer female portion, making lateral adjustments in two linear x-y directions. The configuration of four centering screws 20 is not suitable for making controlled incremental rotational adjustments. Stevens does not have a groove on an outer die portion.

Accordingly, Claims 1, 2, 6-8, 11 and 12, as amended, are not obvious in view of Stevens since Stevens does not teach or suggest an "outer member having an annular shoulder with an opening through which the outer die portion passes, the annular shoulder capturing the flange extending from the outer die portion and extending into a groove adjacent to the flange, the annular shoulder and groove being configured to allow movement of the outer die portion relative to the outer member," as recited in Claim 1, as amended, or similarly in Claim 8, as amended. Reconsideration is respectfully requested.

Shinmoto discloses in FIGs. 1 and 2 a die for extruding a film in an annular shape through an annular lip or gap 2a. About twenty (20) evenly spaced adjusting screws 2f extend through a lip adjusting ring 2e for evenly and radially adjusting the annular lip 2a every 18° over the entire diameter in order to obtain a film with consistent thickness around the diameter. Shinmoto does not have peaks and valleys, or a groove on an outer die portion.

Accordingly, Claims 1, 2, 6-8, 11 and 12, as amended, are not obvious in view of Stevens and Shinmoto since neither reference, either alone or in combination, teach or suggest an "outer member having an annular shoulder with an opening through which the outer die portion passes, the annular shoulder capturing the flange extending from the outer die portion and extending into a groove adjacent to the flange, the annular shoulder and groove being configured to allow

movement of the outer die portion relative to the outer member," as recited in Claim 1, as amended or similarly in Claim 8, as amended. Reconsideration is respectfully requested.

Grosset discloses in FIGs. 1-4 an extrusion core 24 which is fitted along with a series of rings 32a, 32b, 32c and 34 to an internal hollow part 36, outer hollow part 38 and extrusion nozzle 44. The extrusion core and nozzle each have peaks and valleys, but there are no adjustment screws disclosed for making any adjustments. Presumably, the parts, when fitted together, provide the proper gap spacing.

Accordingly, Claims 1, 2, 6-8, 11 and 12, as amended, are not obvious in view of Stevens and Grosset, or in view of Stevens, Shinmoto and Grosset, since none of the references, either alone or in combination, teach or suggest an "outer member having an annular shoulder with an opening through which the outer die portion passes, the annular shoulder capturing the flange extending from the outer die portion and extending into a groove adjacent to the flange, the annular shoulder and groove being configured to allow movement of the outer die portion relative to the outer member," as recited in Claim 1, as amended, or similarly in Claim 8, as amended. Therefore, Claims 1, 2, 6-8, 11 and 12, as amended, are now in condition for allowance. Reconsideration is respectfully requested.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

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